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Evaluation of Sirococcus Shoot Blight
of Red Pine - 1972 Progress Report

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ABSTRACT

Plots and photographic points were established in 1971 to evaluate damage to red pine by Sirococcus strobilinus Pruess. The 1972 examination of the plots revealed seedling mortality of 19 percent occurred on one plot, 14 percent on another. On 3 other plots few seedlings were killed, although many were damaged. There was an upward progression of symptoms on most of the sawtimber and pole-sized trees on the plots. Comparison of photographs revealed increased damage to 4 of the 12 trees photographed in both 1971 and 1972.

INTRODUCTION

Sirococcus shoot blight of red pine ("Deerskin droop") caused by the fungus Sirococcus strobilinus Preuss (Syn: Ascochyta piniperda) was discovered in northern Wisconsin in 1959 and the causal agent identified in 1972. The disease was found in northern Minnesota and Upper Michigan in 1970.

Previous to 1972, Sirococcus strobilinus had not been reported on red pine, nor in the Lake States. However, the pine fungus has been recorded as a cause of damage to spruce, fir, and pine in Europe since 1890 (Hartig) and in the U.S. since 1914 (Graves). Outbreaks on Jeffrey pine and hemlock have occurred recently on the west coast on North America (Funk 1972, Smith et al 1972).

On all susceptible species, Sirococcus strobilinus attacks the current shoots. The fungus infects by means of asexual spores, which during periods of wet weather are exuded from fruiting bodies found at the base of needles of shoots killed previously (Figure 1).

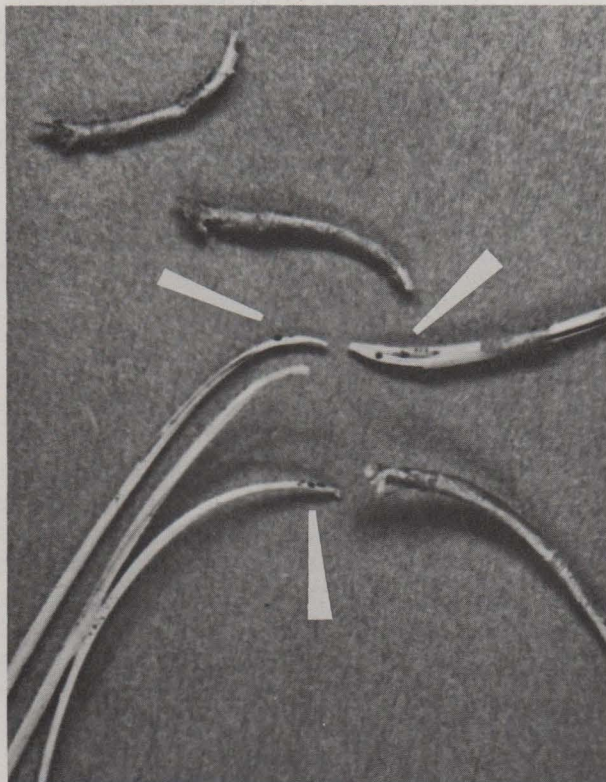


Figure 1. Pycnidia of Sirococcus strobilinus on red pine needles.

The nature of the spores suggests they are not windborne in the usual sense, but are carried about in raindrops or dew and fall upon, or are windblown to healthy shoots. Once it has penetrated to the cambial area of a red pine shoot, the fungus spreads there, causing pitching and a consequent brown stain, and usually girdles the shoot. Injuries not lethal to the entire shoot occasionally occur, and only a few needles may die. It is suspected that the fungus also causes bud mortality.

Death of the entire tree occurs when defoliation - due to the progressive loss of shoots - reaches the point where photosynthesis is no longer sufficient to sustain the tree. Small trees beneath or immediately downwind from infected large ones are readily

infected and easily killed. The large trees too may eventually be killed as the fungus advances upward from branch to branch each year (Figure 2). Probably such movement occurs as spore-laden raindrops are thrown upward when the branches are tossed about in the wind.

A 1970 survey on the Nicolet National Forest showed the disease present in 11 of 33 stands examined (O'Brien and Erickson, 1971). Subsequently, it was found affecting 3,000-5,000 acres of red pine on the Superior National Forest and 3,000 acres on the Nett Lake Indian Reservation (northern Minnesota), in addition to 5,000-10,000 acres in scattered stands in northern Wisconsin and Upper Michigan. However, surveys have given little information as to the impact the disease will have on the infected stands. Hence, an evaluation was begun in 1971.



Figure 2. Red pine infected with Sirococcus strobilinus

METHODS

To evaluate the damage to individual infected trees (mostly sawtimber size), 18 photographic points were established. The trees are photographed from the same point annually and any changes noted. A tripod-mounted 35mm camera with a 50mm normal lens and Kodachrome II film is used for most photographs. For three, a 4 x 5 press camera with a 270mm lens and Kodak Ectapan and Tri-X ortho film is used. Stakes were placed at the points (center of the tripod) and their locations mapped. There are 8 photographic points on the Nicolet National Forest (established 1971), 4 on the Nett Lake Indian Reservation (established 1971), and 6 on the Superior National Forest (established 1972).

Damage to stands is being evaluated on 16 plots. Four of these are of nonstandard and undetermined size and shape, the rest are 1/5 acre circular plots. There are 2 plots on the

Nicolet National Forest (at Scott Lake and Kimball Creek, established in 1971), 4 on the Nett Lake Indian Reservation (established in 1971), and 10 on the Superior National Forest (1 established in 1971, 9 in 1972). All trees on these plots are examined for infection and their condition (dead or alive) recorded. When practical, i.e., on trees having 100 or fewer shoots, the shoots were counted and their condition (healthy or disease-killed) recorded. On saplings with more than 100 shoots, only dead shoots are counted. On poles and sawtimber sized trees, the dead whorls and the whorls having dead shoots present are counted. One plot (at Scott Lake, established in early summer 1971) has been examined 3 times. The Nett Lake and Tofte plots (established in late summer, 1971) have been examined twice, and the remaining Superior plots (established in 1972), once. All plots except Kimball Creek, Nett Lake #4 and two Superior plots have seedlings and saplings overtopped by larger red pine.

Variety of plots

RESULTS AND DISCUSSION

Four of the photographs revealed a decline in the health of the subject trees. Two of these trees are saplings overtopped by larger trees, and were severely damaged. On each of the other two, the proportion of shoots killed was about the same. However, one tree had been more seriously damaged before the first photographs were made and probably could not afford the same loss of shoots that the healthier tree could. On 8 of the 12 trees photographed twice, no change was visible.

Results of the 1971 and 1972 examinations of the plots having seedlings and saplings, except the 1972 Superior plots, are presented in Tables 1 and 2. On all plots, most of the

Table 1. Infection of seedlings and saplings by *Sirococcus* shoot blight and consequent mortality.

| Plot | Trees examined | <u>Infected</u> | | | <u>Dead w/blight (Cumulative)</u> | | |
|-----------------------|----------------|-----------------|---------|------|-----------------------------------|---------|------|
| | | 1971(1)* | 1971(2) | 1972 | 1971(1) | 1971(2) | 1972 |
| ----- (Percent) ----- | | | | | | | |
| Scott Lake | 361 | 23 | 68 | 71 | 1 | 8 | 14 |
| Tofte District | 132 | - | 86 | 98 | - | 0 | 19 |
| Nett Lake #1 | 116 | - | 76 | 82 | - | 0 | 1 |
| Nett Lake #2 | 78 | - | 72 | 86 | - | 0 | 0 |
| Nett Lake #3 | 77 | - | 55 | 69 | - | 0 | 0 |

* Number in parenthesis refers to examination (1 = Early summer, 2 = Late Summer)

seedlings or saplings have at least one shoot infected. Seedling mortality of 14 percent occurred on the Scott Lake plot (an additional 8% mortality had occurred when the first examination was made, but is not shown in the table because the cause of death could not be ascertained). High seedling mortality (19% in a single year) also occurred on the Tofte plot. Infection data suggest more mortality can be expected on both the Scott Lake and Tofte plots. Reduction in the total number of shoots appears to be of concern only on the Tofte plot (Table 2). However, loss on the other plots may be more serious than the table implies because as the trees grow, they need more foliage to survive. Moreover, on two of the three plots on which two counts were made, the percent increase in dead shoots is higher than the percent increase in total shoots. This indicates the trees are not able to maintain even a static condition and are gradually being overcome by the disease.

Table 2. Effect of Sirococcus shoot blight on seedlings and saplings - loss of shoots

| Plot | Total number of shoots 1971 | Percent Dead | Total number of shoots 1972 | Percent Dead | 1971-1972 Percent increase in Total shoots | Percent increase in Dead shoots |
|----------------|--------------------------------|-----------------|--------------------------------|-----------------|---|------------------------------------|
| Scott Lake | 1454 | 43 | 2272 | 41 | 56 | 47 |
| Tofte District | - | - | 2380 | 78 | - | - |
| Nett Lake #1 | 1506 | 26 | 2790 | 28 | 85 | 100 |
| Nett Lake #2 | 227* | 14 | 371* | 16 | 64 | 102 |

* On 27 seedlings, other trees too large to count shoots.

Infection on poles and sawtimber-sized trees proved rather difficult to discern from the ground and therefore data (Table 3) is not as reliable as that on the smaller trees. However, on 2 of the plots, an upward movement of the disease is unmistakable, and it is progressing much more rapidly than the annual addition of whorls.

Table 3. Effect of Sirococcus shoot blight on poles and sawtimber

| Plot | Trees Examined | Average number of whorls affected <u>1/</u> | | | |
|----------------|-------------------|---|-------|--------------|-------|
| | | 1971 | Range | 1972 | Range |
| Scott Lake | 64 | 13 | 2-20 | 14 | 6-19 |
| Kimball Creek | 44 | 13 | 9-18 | 18 | 10-24 |
| Tofte District | 14 | 11 <u>2/</u> | 4-13 | 11 <u>2/</u> | 4-22 |
| Nett Lake #4 | 32 | 2 | 0-8 | 8 | 3-18 |

1/ Dead whorls plus whorls with infected shoots

2/ Changes on individual trees did occur, but average disease advances were balanced by apparent declines (infection no longer visible)

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